भारतीय मानक
Indian Standard

IS 17422 : 2021

नदी घाटी परियोजना के पर्यावरणीय स्वास्थ्य प्रभाव के मूल्यांकन — दिशानिर्देश

Assessment of The Environmental Health Impacts of River Valley Projects — Guidelines

ICS 13.020.30

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June 2021 **Price Group 3**

Environmental Assessment and Management of Water Resources Projects Sectional Committee, WRD 24

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Environmental Assessment and Management of Water Resources Projects Sectional Committee had been approved by the Water Resources Division Council.

The aim of Environmental Health Impact Assessment (EHIA) is to provide the decision maker with the best possible information on the environmental health effects by predicting and assessing the impacts of development on environmental parameters, which have a strong significance for health. These include, for example, increase in levels of malaria-carrying mosquito populations, increased contact between human and parasitic diseases, etc. In predicting future changes in environmental health factors, it is possible to indicate the potential changes in health which may be caused by development. These indications may then be used by local health experts, in conjunction with other considerations, to assess future changes in morbidity and mortality for presentation to the decision maker.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

Indian Standard

ASSESSMENT OF THE ENVIRONMENTAL HEALTH IMPACTS OF RIVER VALLEY PROJECTS — GUIDELINES

1 SCOPE

This standard provides guidance on the methodology and criteria for Environmental Health Impact Assessment for the projects on hydropower, irrigation, drainage, flood control and multipurpose river valley projects.

2 AREAS WHERE ENVIRONMENTAL CHANGE IS TO BE CONSIDERED

In case of hydropower, irrigation, drainage, flood control and multipurpose projects, the development interacts with the environmental health hazards to cause environmental change, associated with the hydrological changes. The areas of such interaction are, but not limited to the following:

a) Areas of construction activity for example areas involving blasting and excavation activities, vehicular movement, dumping and quarry activities, creation of temporary access routes and clearance of vegetation.

b) Areas where water is made available for the development through canals, irrigation channels, etc.

c) Areas where inundation takes place with the construction of a dam or reservoir.

d) Areas where there is movement of people away or near to the project area for eg. areas involving introduction of workforce for construction of a project and where rehabilitation of communities is done.

e) Areas of change in agricultural practices.

f) Areas involved in introduction or expansion of fisheries/hatcheries.

g) Areas involved in generation/storage/disposal of municipal/biomedical/hazardous wastes in new and relocated communities and in temporary communities during construction.

h) Areas used in the provision of infrastructure for permanent and temporary communities including roads, transport facilities, water supply, other services and utilities.

j) Areas involved in maintenance measures including pest control, channel clearance.

3 BASELINE INFORMATION

Environmental Health Impacts of a given water resources project may be identified through information on local environmental and social conditions besides important temporal and spatial variations along with their time period and geographical coverage. As far as possible existing information should be utilized for compiling the baseline information and a long term monitoring mechanism should be devised for collecting additional information as the project progresses. Information should necessarily be site specific. Information of one area cannot be assumed to apply equally to a different, although superficially similar, area. Information on system failures should be collected, even by inferring likely failure rates from experience with similar projects elsewhere.

This baseline information should include the following:

a) The major health problems in the area along with the level of infection and degree of resistance, and/or diseases introduced by the migrants and incoming settlers.

b) Existing physical, biological and environmental factors determining disease levels in an area and exposure to disease.

c) The size, location and characteristics of the existing human population, the degree of contact with water, sanitation arrangements, and eating habits to determine transmission pathways for existing disease problems.

d) The degree of resistance of the weeds and pests for the weedicide and pesticide.

e) The nutritional status of new settlers especially for children in the age group of under 5 years.

f) Prevalence of water borne, water washed and water based diseases.

g) The specific vector species (of mosquito, snail, bird etc.) and disease organisms responsible for the transmission of diseases. The baseline data should include their life-cycles, breeding periodicity and periods of maximum disease transmission.

h) Prediction of effects of development on hydrology and water quality particularly in new water bodies including increased salt levels in downstream flows.

j) Information on medical/health infrastructure availability in the project area and its vicinity, namely. Primary Health Centre/Medical sub-centre/District Hospital etc and necessity of strengthening the same after evaluating the present and future needs of the local people/project.

k) Information on medical facilities including medical/paramedical staff available in these centers

m) *No project scenario* — There will be changes in the environment and health even if the proposed activity is not implemented. These should be taken into account in the assessment to provide a 'moving baseline' for comparison

4 METHODS OF OBTAINING BASE LINE INFORMATION

4.1 Available Information

Information on the existing environment can be obtained from local or national government statistics on population and health or from previous environmental and, ecological studies of the area or by conducting new studies/surveys.

4.2 Field Information

A comprehensive survey programme must be designed specifically for each different location, taking into account the local conditions and amount of information already available. The programme may require inputs from a range of specialists, including medical specialists, environmental health specialists, ecologists and biologists. This input should be over a period of time sufficient to encompass seasonal variations in habitats and life-cycles. Adoption of time and cost effective methods like utilisation of multi-spectral and multi-temporal satellite data and dynamic monitoring may be resorted to for environmental health impact assessment, wherever possible. The survey programme should include, but is not limited to, the following:

a) Surveys of existing health problems which may include medical examination of a sample of the local population over a period of time to establish levels of infection, resistance to disease and disease variations with time. The sample of population examined should cover a range of ages, occupations and locations within the area. The level of infection may be found using various indices like Annual Parasite Index for Malaria, Breateux Index for Dengue.

b) Prevalence of cases with fever and skin infection needs to be collected. A high prevalence or a sudden increase in such cases indicates a rise in water borne and water washed diseases. Hence quality of water needs to be studied.

c) Detailed study/observation of current social habits, particularly detailed examination of sanitation, and of human contact with water should be done to establish current transmission routes.

d) Vector Population sampling should be done to establish the main transmitters of disease. Field observations over a period of time should be done to establish the life-cycle, habitats and limiting factors for the vector species identified.

4.2.1 Establishment of a monitoring system to detect the following:

a) Change in prevalence of malnutrition over a period of time for children in the age group of under 5 years.

b) Change in prevalence of water borne, water based and water washed diseases over a period of time.

c) Change in pattern of endemic diseases by introduction of new diseases.

5 POTENTIAL ENVIRONMENTAL HEALTH IMPACTS

5.1 Effects due to the project can be beneficial or adverse and its impacts on all aspects of health need to be studied in detail.

5.2 Effects can be local, regional, or national in scale. Effects may be reversible or irreversible, or irreparable. Effect can occur over the short or the long term, they may be temporary or continuous, and they may increase or decrease with time.

5.3 Effects may be direct or indirect. A project activity may stimulate other developments which may have effects on the environment and health; these indirect effects must also be considered as consequences of the proposed project activity. A project activity may also establish precedence for further development which may ultimately result in a much greater effect on the environment and health. Effects are not necessarily restricted to the immediate interaction between a project activity and the environment but these primary effects by themselves can be the cause of secondary and higher order effects. Natural events in the surrounding environment (floods, etc) may also cause the project activity to lead to exceptional effects.

5.4 Conducive conditions lead to increase in water washed diseases and spread of communicable diseases by the faecal-oral route. These conditions are overcrowding, pressure on sanitation etc., which may occur in newly relocated communities. New diseases or new strains of the diseases are likely to be introduced in an area through immigration of construction workers or new settlers. Relocated communities/ new settlers get exposed to diseases to which they have little or no immunity. There are also chances of introduction of new vectors, their infection and re-infection with diseases from new settlers and migrant population. Prevalence and distribution of existing infected vectors may also change in relation to hydrological, morphological, climatological, biological changes in the availability of suitable habitats for breeding and survival. There could be overburdening of health and other social services impacting health of residents and workers. All these likely impacts should be thoroughly studied.

5.5 Possibilities of malnutrition, nutritional deficiencies or toxic effects exist. These occur due to changes in staple foods, contamination of soil or agricultural water supplies, pollution of air, water or soil by effluents and emissions, fertilizers or pesticides, reduced productivity of soils and fisheries, lowering or rising of water table etc.

6 ASSESSMENT AND PREDICTION OF POTENTIAL ENVIRONMENTAL HEALTH IMPACTS BASED ON EXAMINATION OF THE PROPOSED WATER RESOURCES PROJECTS

6.1 The various assessments that need to be undertaken are, but not limited to, the following:

a) Assess effects of the irrigation system on hydrology, levels and velocity of water flow, rates of seepage from the system, location and seasonality of standing water and existence of wave action. Assess effects of the irrigation system on water quality and temperature. Also assess effect of submergence/ clearance of vegetation, aquatic vegetation and canal bank plantation.

b) Collect and compile information on the nature of the completed irrigated agriculture development, for example the configuration of the channels, spillways, storage ponds, steepness of banks, materials to be used for construction, access roads, temporary accommodation for construction workers, etc. Information on operation of the system for eg. frequency of inundation, maintenance of water levels, use of chemicals etc. may also be assessed.

c*) Health related assessment* – Health Risk – Assessment needs to be done for the residential population in that area. This includes Hazard Identification, Exposure assessment, Dose Response Assessment, Risk Characterization wherever applicable. The various assessments required are as follows:

   1) Assess change in incidence of water borne diseases including change in habitats and in prevalence for water borne disease organisms, changes in human exposure to water which contains disease organisms.
   2) Assess change in incidence of water based diseases including changes in habitats and in prevalence for aquatic disease vectors including changes in human exposure to water which contains disease organisms.
   3) Assess change in incidence of water related diseases including change in habitats for insect vectors; change in prevalence of disease transmitters, change in human exposure to insect vectors.
   4) Assess change in incidence of water washed diseases with the change in availability of water and/or personal hygiene facilities and/or change in personal hygiene practice.
   5) Assess change in incidence of all diseases with the immigration of an infected work force; immigration and sub-sequent emigration of previously uninfected workforce; relocation of communities; settlement of newcomers.
   6) Assess effects of the increased surface water, rise in water table, changes in water flow, microclimatic changes, changes in human settlement etc., irrigation system structure and hydrology on disease organisms and vector habitats, feeding and breeding sites etc.
   7) Assess and predict changes to environment and habitat factors favoring disease transmission and effects of changes in these factors on disease vectors. Assess considerations for increased longevity of mosquitoes, increasing the probability of biting humans more than once and thus transferring the disease.
   8) Assess availability of water supplies and/or personal hygiene facilities within the scheme and assess proper disposal of human waste.

6.2 The various predictions that need to be done are, but not limited to, the following:

a) Prediction of how human exposure to disease will change following the development and future incidence of disease in human beings.

b) Prediction of changes in incidence of water borne, water based and water related disease

c) Prediction of change in number of cases of disease and change in individual risk of disease, following the development

7 QUANTIFICATION OF THE IMPACTS

Quantification of the identified impacts should be done inorder to describe the change in different environmental health factors and the variables to measure the ultimate impact leading to the effect. This should follow the following logical sequence:

a) Predictions should be done to find out the severity of impacts on the present state of the physical, biological and human environment, using available data or by surveys and monitoring;

b) Comprehensive predictions to give complete information on how the physical, biological and human environment will change and how these changes will affect environmental health factors, for adoption of appropriate mitigating measures.

c) Prediction of likely changes in disease incidence based on detailed information about the existing disease levels in the project area, prevailing social conditions and experience gained from similar projects elsewhere.

d) Expert judgment to correlate information on magnitude of the future changes in the environment and on human exposure to disease in future disease incidence, to be followed by extrapolation to different areas and projects.

8 MITIGATION MEASURES

Adverse effects on health may be reduced by measures designed to influence identified factors. These measures should be specific to the aims of the project, types of development, stages in construction or operation, local climate and physical conditions and should include local, social, cultural, economical and political factors. They should allow the aims of the project to be achieved within the required time-period. These measures should also be specific to the types of disease organisms and vectors causing health effects. Key groups of measures are as indicated below:

a) Existing knowledge about design which can reduce adverse impacts on health must be gathered and used in designing the project

b) For preventing a problem from arising, smaller scale control of the environment during the operational phase is required like using physical measures including scrubbing of vector breeding sites and drainage of waterlogged areas, chemical measures such as spraying and biological methods such as introduction of a competitor or predator species.

c) Control of human behavior to reduce vector-pathogen contact is achieved through provision of alternative safe water supplies, location of settlements away from main water bodies or reducing recreational and sanitary use of water bodies, ensuring adequate supplies of water for washing etc. Provisions of sewage treatment, and refuse/excreta disposal, controlling secondary disease hosts in zoonotic diseases, provision of adequate health care facilities and health monitoring.

d) Suitable measures may be resorted to prevent or eliminate disease effects on human health. Based on the monitoring system established, continuous surveillance is needed for early intervention to control the spread of water borne, water washed and water based diseases.

e) Measures need to be taken for proper collection, segregation, storage, transportation, processing and disposal of municipal solid waste, bio-medical waste, hazardous wastes from the construction and rehabilitation sites etc.

9 ORGANISATION AND PRESENTATION OF INFORMATION

In a decision making process, a choice is made amongst, implementing the project as proposed , implementing measures designed to minimize undesirable impacts, choosing an alternative development or abandoning the project, altogether. Inorder to aid the decision making in the environmental health impact assessment process for the implementation of a river valley project the following information should be presented sequentially:

a) Identification of the key issues based on analysis of results which may affect the decision;

b) Organization and presentation of the results of the assessment in a matrix format, between impacts and alternatives;

c) Assigning the weights;

d) Summarization into key alternatives and impacts;

e) Indication of the factors affecting the decision, such as cost and technical feasibility; and

f) Proposed mitigation measures.

The approach should be to present information about all the impacts of alternative courses of action or identify those impacts which are crucial to the decision or to illustrate how the decision might be affected by different judgments about the relative importance of impacts.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Composition of Environmental Assessment and Management of Water Resource Projects Sectional Committee WRD 24

Organization	*Representative(s)*
Central Water Commission, New Delhi	Shri Amrendra Kumar Singh (***Chairman***)
Central Board Of Irrigation & Power, New Delhi	Dr G. P. Patel Shri Uday Chander (*Alternate*)
Central Ground Water Board, New Delhi	Shri G. C. Pati Srimati Rumi Mukherjee (*Alternate*)
Central Pollution Control Board, New Delhi	Shri R. M. Bhardwaj Shri N. C. Durgapal (*Alternate*)
Central Water Commission, New Delhi	Director (EM) B. B. Saikia Deputy. Director (EM) (*Alternate*)
Geological Survey of India	Dr K. Jayabalan Deputy Director General (*Alternate*)
Maulana Azad Medical College, New Delhi	Dr Nandini Sharma Dr S. Kerketta (*Alternate*)
Ministry of Environment & Forests, New Delhi	Dr Mohit Saxena Deputy Director (*Alternate*)
Narmada Control Authority, Indore	Shrimati Usha Dwivedi
Narmada Water Resources and Water Supply Department, Gandhi Nagar	Shri V. P. Kapadia
National Institute of Hydrology, Roorkee	Dr C. K. Jain Dr Pradeep Kumar (*Alternate*)
Regional Remote Sensing Centre-East Under National Remote Sensing Centre, Hyderabad	Dr S. Bandopadhyay Dr V. M. Chowdary (*Alternate*)
National Water Development Agency, New Delhi	Shri R. K. Jain Shri Muzaffar Ahmad (*Alternate*)
NHPC Limited, Faridabad	Shri Gaurav Kumar Shri Ashis Kumar Das (*Alternate* I) Ms Shreya (*Alternate* II)
North Eastern Regional Institute of Water and Land Management, Assam, Tezpur	Prof Amulya Ch. Debnath Dr Uzzal Mani Hazarika (*Alternate*)
NTPC Limited, Noida	Dr Vijay Prakash Dr D. L. Nandeshwar (*Alternate*)
THDC (India) Limited, Rishikesh	Dr D. L. Bhatt, DGM Shri Suraj Agarwal (*Alternate*)
Wapcos, Gurugram	Dr Aman Sharma Shri A. Stephen Leo (*Alternate*)
Meri, Water Resources Department, Maharashtra, Nashik	Superintending Engineer Executive Engineer (*Alternate*)
ICAR – Central Inland Fisheries Research Institute, Kolkata	Dr B. K. Das
IIT Roorkee	Dr Surendra Kumar Mishra

Organization	*Representative(s)*
Cetus Consulting Solution Services Pvt Ltd,	Dr Ajay Pradhan Dr Vivek Kumar Singh (*Alternate* I) Principal Scientist (*Alternate* II)
IRG Systems South Asia Pvt Limited, New Delhi	Shri Amit Jain Shri Krishna Kumar (*Alternate*)
Rs Environlink Technologies Pvt Ltd, Gurgaon	Dr Arun Bhaskar
India Water Partnership	Dr Veena Khanduri
TERI School of Advanced Studies	Dr Vinay Shankar Prasad Sinha Shrimati Ranjana Ray Chaudhari (*Alternate*)
Alternate Hydro Energy Centre Indian Institute of Technology, Roorkee	Prof Arun Kumar Prof M. K. Singhal (*Alternate*)
Mu Gamma Consultants Pvt, Ltd	Dr Girija K. Bharat Ms Avanti Roy Basu (*Alternate*)
University School of Environment Management, GGSIP University	Dr Deeksha Katyal
AIIMS Rishikesh	Dr Surekha Kishore
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Forest Survey of India	Shri Abhay Kumar Saxena
In Personal Capacity (*Jawaharlal Nehru University, New Mehrauli Road, New Delhi*)	Dr A. L. Ramanathan
In personal capacity (*A-66, Vrindavan Apartment, Plot No. 1, Sector-6, Dwarka, New Delhi*)	Er R. K. Khanna
In personal capacity, (*Dept of Sociology Maitreyi College, Delhi Univ South Campus, D-104, Anand Niketan, New Delhi*)	Dr M. Kapur Shankar Dass
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Shri Alok Singh
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This Indian Standard has been developed from Doc No.: WRD 24 (10946).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Published by BIS, New Delhi